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UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

NATURAL RESOURCES MANAGEMENT AND SUSTAINABLE DEVELOPMENT
THE CASE OF THE GOLD SECTOR IN GHANA

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PREFACE

i. The United Nations Conference on Trade and Development (UNCTAD) has commissioned this country case study on natural resources management and sustainable development in Ghana, with particular reference to the gold sector. It is one of a series of country case studies on various commodities, prepared within the UNCTAD programme on "Improved Natural Resources Management in the Commodity Sector". The programme consists of a series of activities which are linked together around the unifying objective of achieving a sustainable use of natural resources while maximizing the contribution of the commodity sector to development. These case studies have two main objectives:

(a) Against the background of practical experience, formulate conclusions that can be applied in devising and implementing policies aimed at improving environmental protection and natural resource-management in the commodity sector in developing countries.

(b) To raise awareness in commodity importing countries, funding agencies and the international environmental community of the opportunities for, and constraints to the improvement of environmental conditions associated with commodity production and processing in developing countries.

Terms of Reference

ii. The terms of reference as set out by the UNCTAD secretariat are as follows:

(a) identify the specific environmental effects of gold production and processing in Ghana;

(b) describe current policies that deal with these environmental effects;

(c) evaluate the effectiveness of the policies and investigate the causality and interplay between global and sector-specific economic policies, such as economic growth, foreign exchange generation and revenue generation, and the environmental effects of gold production and processing;

(d) assess whether the desired environmental objectives could have been attained more effectively through other means or under more favourable economic conditions; and

(e) draw conclusions which, to the extent possible, should allow generalizations that may be of use to other countries.

I. INTRODUCTION

1. Ghana is located in West Africa, sharing borders with Togo in the east, Burkina Faso in the north, and Côte D'Ivoire in the west. The country has an area of 239,000 square kilometers (23.9 million ha) and can be divided into six main agro-ecological zones (coastal savanna, rain forest, deciduous forest, transition, Guinea savanna and Sudan savanna). The annual rainfall ranges from a low of 800 millimeters in the coastal savanna to a high of 2200 millimeters in the rain forest.

2. The country has been divided into 10 regions for administrative purposes. The population of Ghana is estimated to be 16 million (1992), increasing at a rate of more than 3 per cent per annum and projected to almost 20 million in the year 2000. Population density averages 67 km^2, though there are marked regional variations, from 17 persons/km^2 in the Northern Region to 116 persons/km^2 in the Central Region. Much higher densities occur locally, especially in the Upper East Region and in areas around Kumasi, Cape Coast and Accra, where densities exceed 400 persons/km^2. More than 30 per cent of the population lives in urban areas of 5,000 inhabitants or more. Agriculture employs more than 60 per cent of the labour force, who are generally rural dwellers.

A. Ghana's economy

3. The Ghanaian economy depends principally on four traditional exports: minerals (including gold), cocoa, timber and electricity. So-called non-traditional exports (NTEs) represent 7 per cent of the country's total exports. The main NTEs include pineapples, yams, tuna, shrimp and lobster, salt, wood products, rubber and handicrafts.

4. Inappropriate macroeconomic policies, weak overall economic management and internal and external shocks resulted in negligible growth in the Ghanaian economy during the 1970s. The situation deteriorated sharply in the early 1980s as real gross domestic product (GDP) declined at an average annual rate of 5 per cent. During the period 1970-1983, all key sectors, agriculture, industry and services, registered negative average annual growth rates. The population, however, grew at a rapid rate during this period. An intercensal growth rate of 2.6 per cent per annum was recorded for the period 1970-1984. From 1984 to 1992, the average annual population growth is estimated to have been 3.3 per cent. The combination of very rapid population growth and a prolonged decline in aggregate economic performance resulted in a continuous and severe decline in per capita income.

5. At the same time, the mounting population pressure on the country's natural resource base and the absence of incentives for prudent and sustainable management of these resources combined to fuel an accelerating degradation of the environment - both natural and man-made. Degradation related to crop and livestock production activities imposes the greatest cost to the Ghanaian economy, with a total estimated annual cost of at least 28.8 billion cedis in 1988, corresponding to about US$125 million at the exchange rate at the time. The total cost borne by the country as a result of the loss of forests through fire, logging,

fuel wood extraction, charcoaling and agricultural encroachment was estimated at 10.8 billion cedis per year, or about US$50 million. These estimates imply that Ghana's economy sustains losses due to environmental degradation that are on the order of 4 per cent of GDP per year. Only since 1984 has the GDP growth rate attained an average of about 5 per cent per year. In other words, Ghana's economic growth, even when it has been clearly positive as measured by conventional methods of national income accounting methods, is almost offset by the degradation of the country's natural resource base and the consequent destruction of the foundation for future sustained growth and development.

6. In April 1983, the Government launched an ambitious programme of economic policy reforms designed to arrest the decline and to put the economy on a positive growth path. The Economic Recovery Programme (ERP) was given both financial and technical support by the World Bank, the International Monetary Fund (IMF) and other donors. The components of the reform efforts involved a broad constellation of stabilization and growth inducing measures: (i) depreciation of the cedi to about one tenth of its 1983 value and the introduction of a floating exchange rate to stimulate exports and to narrow the differential between the parallel and official rates; (ii) privatization and introduction of cost recovery schemes in parastatal enterprises to enhance their efficiency and profitability; (iii) reduction in the size and scope of the public sector, as well as an expansion of the role of the private sector in the production and marketing of goods and services; (iv) liberalization of credit and monetary arrangements; and (v) creation of an enabling environment for foreign and domestic investment.

7. With these measures firmly in place, real GDP, for the first time in a long period, registered a positive growth rate of about 8.6 per cent in 1984. For the period 1984-88, GDP recorded an average growth rate of about 5 per cent per annum, and the average annual growth rate from 1988 to 1993 remained similar at 4.8 per cent. Recent studies have shown, however, that despite the impressive growth rate in the country's economy, the growth cannot be sustained if the country's exports do not increase significantly. It has been estimated that exports, excluding gold, cocoa, timber and fuel, must grow 37 per cent per year just to prevent a widening trade deficit. For this reason, the Government is paying particular attention to NTEs and the manufacturing sector.

8. An overview of Ghana's export performance from 1983 shows that exports increased from US$ 439.1 million in 1983 to an estimated US$891.0 million in 1990, a 98.4 per cent increase. Of this total increase in exports (US$451.9 million) US$355.4 million or 79 per cent was represented by the four largest exports - cocoa, gold, timber and electricity. Exports peaked in 1989 at US$1,024 million but failed to reach the same level in following years (US$998 million in 1991 and US$986 million in 1992), mainly due to a deterioration in the price of cocoa and despite rapidly increasing exports of gold. The unit value of exports decreased from 65 in 1988 to 48 in 1992 (1980=100), while export volume increased by 32 per cent. Terms of trade decreased by 34 per cent. A small surplus in the trade balance in 1988 turned into a deficit of US$471 million in 1992, or more than 6 per cent of GDP. While remittances from Ghanaians abroad and donor resource flows have made up at least most of the difference, it is clear that there is an urgent need for export expansion (both in the traditional and non-traditional exports) and diversification.

9. For the long-term success of the ERP, the country has to increase and diversify its export revenues. The medium- to long-term prospects for gold are very encouraging, whereas those for cocoa are difficult to predict, although prices increased significantly in 1994. If the annual growth rates for Ghana's traditional exports (gold 5 per cent, cocoa 2 per cent, timber 1.3 per cent and electricity 0.5 per cent), are maintained during the latter half of the 1990s, then a significant increase in NTEs is imperative. The indications are encouraging, and if a concerted effort is made and the right policies adopted, then the non-traditional exports can make immense contributions to the economy. It is also noteworthy that there is an urgent need for the country to increase the value added of its raw commodity exports.

B. Economy and mining

10. Due to the country's favourable geology, the mineral production potential of Ghana is large. The main mineral deposits in the country comprise gold, diamonds, bauxite, manganese and iron ore (of medium quality). There are also deposits of tin, titanium and impure graphite. Sporadic occurrences of lead, copper, molybdenum, tungsten, niobium, barytes and asbestos are known. The presence of uranium, cassiterite, platinum, molybdenite and tantalite has been reported. Large deposits of some industrial minerals are also known.

11. As has been stated above, gold is the main focus of activities for mining companies in Ghana. In early 1993, 85 local companies and 23 foreign companies held gold prospecting and reconnaissance licenses. Thirteen mining leases for gold had been granted to mining companies from 1986 to 1992. It is noteworthy that much of the estimated US$880 million invested in the mining sector (excluding exploration expenditure) since 1983 has been in gold. Eighty per cent of foreign exchange earnings from mineral exports (gold, manganese, diamonds and bauxite) are from gold exports.

12. In 1993, the mining sector was the leading foreign exchange earner for the country and accounted for approximately 30 per cent of the country's foreign exchange earnings. This is expected to increase in the short to medium term because of the significantly increased gold output (see table 1), which can be sustained for the next two decades at least, given the country's potential.

13. The gold industry is playing an increasingly crucial role in the country's economy as a result of the stagnation of foreign exchange earnings from cocoa - the former leading foreign exchange earner for the country. Gold production contributes a large portion of the country's export earnings and accounts for a large part of government income in the form of taxes and royalties. The sector directly employs over 35,000 people, of whom about 11,000 are officially known to work in the small-scale gold mining sector. It has been conservatively estimated that each employee in the large-scale mining sector in the country directly supports about five other persons. The value of total mineral production had reached approximately US$400 million in 1993, corresponding to 6 per cent of GDP.

Table 1. Ghana's mineral output

Company	1990	1991	1992	1993	1994
Gold (kilograms)					
Ashanti Goldfields	13,475	19,343	21,388	23,823	26,551
Teberebie Goldfields	214	2461	3,997	5,122	5,514
Billiton Bogosu Gold	127	1,918	2,428	2,940	3,391
State Gold Mines (SGMC)	1,593	1,728	1,496	1,333	694
Tarkwa	764	858	826	557	-
Prestea	639	708	525	654	612
Dunkwa (dredging)	190	162	145	122	82
Southern Cross	833	379	-	-	-
Small scale mines	536	264	338	1,046	2,872
Goldenrae Mining	26	172	55	248	-
GLAMCO	22	20	-	-	-
Gold Fields (Gh) Ltd.				664	1,255
Bonte Gold Mines	-	17	151	232	506
Ghana Consolidated Diamonds (GCD)	13	8	-	-	-
Ghanaian Australian Goldfields	-	-	1,178	3,853	3,689
Cluff Mining Co., Ltd.					139
Total gold	**16,839**	**26,310**	**31,031**	**39,261**	**44,611**
Diamonds (carats)					
GCD diamonds[a]	151,627	145,887	214,155[a]	214,442	143,499
Small and medium diamond mines	484,876	541,849	479,874	376,400	405,830
Total diamonds (carats)	**636,503**	**687,736**	**694,029**	**590,642**	**549,329**
Other Minerals (tons)					
Bauxite (tons)	368,659	324,313	399,155	364,640	451,802
Manganese (tons)	246,869	319,777	279,019	295,296	170,871

[a]Including tributors, that is, miners producing on behalf of GCD.

Source: Ghana Minerals Commission.

14. Generally, the mining sector contributes to the national economy by: (i) earning foreign exchange; (ii) providing revenue for the Government; (iii) providing employment (direct or indirect); (iv) promoting rural development; (v) supplying raw material inputs for domestic industries; (vi) stimulating industrial developments through backward linkages from mining; and (vii) facilitating skills formation.

C. Human geography and mining

15. Mining has played a major role in the establishment of communications networks, migration streams and urbanization. Railways built in the early part of this century to link Obuasi and Tarkwa to the coast also opened up new mines. Mine workers were brought from all parts of the country and from even beyond. Several mines employed more than 5,000 workers and substantial towns grew up around them (e.g. Obuasi, Tarkwa and Prestea).

16. Mining tends to be one of the spatially more concentrated economic activities in Ghana. In 1960, over 96 per cent of mining employment was located in Western, Eastern and Ashanti Regions. By 1970, the proportion was 94 per cent. Currently, one half of all mining employment is in the Western Region and one third is in Ashanti. The Eastern Region has experienced the most rapid decline in industrial mining employment to the point where, statistically, it is no longer a significant mining area.

17. The migration flows partly created by mining have had at least two major effects. First, migration for mining has created flows that are not directed solely towards the capital city, as has been the case in many ex-colonial states. Secondly, such migration over long periods has, to some degree, broken down traditional regional and ethnic boundaries. These two effects are well illustrated by a comparison between the urban hierarchies of Côte d'Ivoire, Nigeria and Ghana. In the first case, Abidjan is, to an outstanding degree, the dominant city with urbanization elsewhere being very limited; Abidjan contains over 20 per cent of Côte d'Ivoire's population, largely because almost all migration streams within that country have been centered on Abidjan. At the other extreme, Lagos and Ibadan together have only 5 per cent of Nigeria's population and, despite the very rapid growth of these cities, regional centres are extremely important foci of migration. Ghana falls between these extremes: Accra has 8 per cent of the country's population with a regular sequence of regional centres, which neither threaten Accra's primacy nor are overshadowed by it, and which appear evenly across the country.

18. Despite such a long tradition of migration and the fact that mining is an overwhelmingly male industry, which rarely employs women, mining has not unduly warped Ghanaian demography. The overall sex ratio (males per 100 females) in Ghana is 97.3; that in the Western Region is 102.6; and in the Upper West Region 90.2. Thus, while mining has drawn men from the north to the west, it has not done so in an exaggerated way.

D. History of mining production

19. Small-scale mining of gold is many centuries old in Ghana and industrial mining began in the latter part of the nineteenth century, when there was a gold rush to the Gold Coast (Ghana's former name).

20. However, from about 1950, most of Ghana's remaining 11 operating gold mines deteriorated, and the struggling mines requested government grants and loans to promote mine development or simply to maintain operations at prevailing levels. The Government was, however, unable to oblige, and most of the mines either reduced operations or resorted to reclamation mining in the high-grade areas, with the intention of eventually closing down.

21. To forestall economic dislocation, the Government bought all the equity shares of mines threatening to close, and in March 1961, the Ghana State Mining Corporation was formed. The Government reincorporated the State Mining Corporation by the promulgation of the Statutory Corporations Act 1964 (Act 232) and established the State Gold Mining Corporation under Legislative Instrument in 1965. As a matter of necessity, the Government also bought shares in Ashanti Goldfields Corporation which has since become a world-class producer, producing over 770,000 ounces of gold in 1993, corresponding to about 70 per cent of Ghana's production.

22. With the development of South Africa's gold mining capacity, Ghana lost its relative importance in world production; however, gold output in the country expanded steadily, and peaked at close to 1 million fine ounces a year in the early 1960s. Thereafter, the country's gold production declined steadily to its lowest point of 275,000 ounces in 1983, when the trend was reversed and gold output again increased steadily to current levels of over 1 million ounces per annum. It is believed by most experts that the gold belt of Ghana could sustain an annual production of at least 2 million ounces of gold for the next two decades. This is evidenced by the fact that the oldest gold mine in the country, Ashanti Goldfields Corporation (established in 1895), is expected to produce 1 million ounces of gold each year as from 1995.

23. The "renaissance" of the gold industry actually started in 1985/86 with the promulgation of the Minerals and Mining Law, 1986 (PNDCL 153) and the formation of the Minerals Commission (PNDCL 154) to act as a "one-stop investment centre". Of course, the removal of the distortions in the country's economy by the Government and the political stability in Ghana have also been instrumental in attracting foreign investors since the country's favourable geology had been well known in international mining circles even during the years of stagnation.

E. Innovative technologies

24. New technology introduced into the country with regard to exploration, mining, mineral processing and environmental management has transformed the gold industry/sector.

25. New techniques using remote sensing, geophysics, geochemistry and computer software have changed mineral prospecting from "hammer and compass" to the sophisticated and modern forms of mineral exploration. Similarly, the current trend in mining is towards mechanization in both surface and underground mines.

26. The most important development with regard to mineral processing was the successful introduction of the heap-leaching technology in the country in 1986/87 by Southern Cross Mining Limited (SCML). The company's successful treatment of oxidized gold ore, using the well-known cyanide heap-leaching technique, convinced other mining companies and new investors that the technology could work under the country's tropical conditions. As a result of SCML's success, the country's gold ore reserves increased very significantly, literally overnight. Two other companies, notably Teberebie Goldfields, have since successfully utilized the technique. Teberebie Goldfields is effectively using heap leaching to process auriferous blanket (conglomeratic) ores in the Tarkwa area, which is noted for its heavy rainfall during relatively long periods in the year.

27. The next landmark, as far as gold ore processing is concerned, is the introduction of bacterial leaching (bio-leach) technology by Ashanti Goldfields Corporation to treat its lower grade sulphide gold ore. The bio-leaching will be an additional means (i.e. the company already has roasters for calcining) for the company to oxidize its gold- containing sulphide minerals prior to cyanidation. This project is expected to cost around US$70 million and is part of a three-year development programme to increase output from the Ashanti Goldfields from about 680,000 ounces (in 1992) to 1 million ounces. When commissioned, the 220,000 tons per month facility will be the biggest gold processing operation of its type in the world, with throughput five times greater than the next largest operation, located at the Wiluna mine in Western Australia. If successful, this process will increase Ghana's gold ore reserves even further.

28. In short, Ghana has, rather belatedly, become a beneficiary of innovative technologies in gold ore processing which are cost effective and potentially environmentally cleaner. Innovations in environmental management by most of the mining companies have been consistent with the country's environmental policy and guidelines.

II. SPECIFIC ENVIRONMENTAL EFFECTS OF GOLD PRODUCTION AND PROCESSING

A. General

29. The main environmental concerns in Ghana include issues affecting land and water resources ("resource specific problems") and those commonly related to industrial and mining activities, or to human settlements ("location specific problems"). The manifestations, impacts and causes of major environmental problems in Ghana are shown in table 2.

1. Land degradation

30. Land degradation includes both the degradation of soils through erosion with loss of structure and fertility, and degradation of vegetation through deforestation and overuse. The two problems are inter-related and represent the most serious environmental problems facing the country in terms of their economic impact and the area and the number of people they affect.

31. As shown in table 2, the most important types of land degradation in Ghana include the following: erosion (both sheet and gully erosion, with localized wind erosion); soil degradation reflected in declining soil fertility and soil physical deterioration, with localized areas of soil salinity; vegetative degradation, in both rangeland and forests, and deforestation; and degradation due to changes in the hydraulic regime in wetlands, or due to siltation, flooding or coastal erosion. Most of the degradation problems have on-site causes and effects; while flooding and siltation have off-site effects. In Ghana the on-site effects of erosion and soil and vegetation degradation tend to be more widespread and important.

2. Water pollution

32. Water use is virtually unregulated and there is almost no incentive to conserve this resource. Deforestation and reduction in vegetation cover, as well as cultivation close to river and stream banks, have significant impacts on runoff and stream flow with marked seasonal extremes, exacerbated by conversion of wetlands to rice cultivation. High runoff rates reduce water infiltration and aquifer recharge, with lowering of the water table. These factors, combined with uncontrolled discharge of waste water, pose significant threats to human health in rural and urban areas. The major pollutants are untreated wastes from both anthropogenic and industrial (mining and manufacturing) sources. Water-borne and water-related diseases are common in the rural areas.

3. Coastal zone and marine resources

33. The coastal zone is of particular environmental concern because it is the most densely populated part of the country with a high concentration of urban and industrial centres. About 60 per cent of the

Table 2. Manifestations, impacts and causes of major environmental problems in Ghana

	Manifestations	Impacts	Direct causes	Underlying causes
LAND RESOURCES	Soil degradation Fertility decline	Reduced farm productivity Reduced water infiltration, increased runoff	Shortening fallows in shifting cultivation systems Poor farming practices Poor cropping-livestock-agroforestry integration Surface mining without subsequent reclamation	Population pressure Lack of effective agricultural extension Lack of chemical fertilizers Agricultural input & output pricing Feminization of farming Absent-ineffective regulations on mining reclamation
	Soil erosion	Loss of farm productivity Loss of farm land River and reservoir siltation	Loss of vegetative cover, deforestation Bushfires Overgrazing Poor soil & water conservation practices Inappropriate construction techniques for civil works and settlements	Population pressure Land tenure systems Ineffective control of bushfires Lack of effective agricultural extension Agricultural input & output pricing Feminization of farming Absent/ineffective enforcement of engineering & construction standards
	Range degradation	Reduced range & livestock productivity Loss of savanna habitat, biodiversity and wildlife feed sources Reduced supply of bushmeat	Conversion in farmland Bushfires Overgrazing near settlements & water points	Land tenure systems Restrictions on mobility of livestock hardens
	Forest degradation Deforestation	Loss of habitat & biodiversity Climate deterioration Declining wood-fuel supply Reduced supply of non-timber forest products, including bushmeat Increasing burden on women's time	Conversion to farmland Destructive logging Destructive fuel-wood extraction & charcoal production Bushfires	Population pressure Rural-rural migration Land tenure systems Perceptions of "free good" ("open access" syndrome) Lack of alternatives to wood fuel Ineffective forest management Inappropriate logging & charcoaling concession pricing
	Forest, savanna & wetlands ecosystems degradation/loss	Loss of habitat & biodiversity Species extinction Changes in hydrological regimes	Inadequate land-use planning Conversion to farmland Drainage & irrigation development Fuel wood extraction & charcoal production Bushfires Excessive hunting/poaching	Population pressure Weakening of traditional authorities and protection/conservation practices Value perception (short-term value less than long-term value)
FRESH WATER RESOURCES	Freshwater resource depletion	Increased marginal cost of ensuring potable supply Increasing burden on women's time Human & livestock concentration near supply sources	Climate change (reduced rainfall) Low infiltration, high runoff Poor on-farm water conservation practices Deforestation in headwaters areas	Perception of "free good" ("open access" syndrome) Lack of effective regulatory framework for water abstraction and exploitation
	Freshwater quality degradation	Health impacts (high morbidity & mortality) Reduced labour productivity Increased marginal cost of ensuring potable supply	Destruction of protective strip vegetation Silt and agrochemical runoff from fields Uncontrolled discharge of urban, industrial & mining wastes and effluents Absent/poor sanitation & waste treatment facilities Livestock excreta Aquatic weed	Weakening of traditional authorities and protection/conservation practices Poor agricultural extension services Lack of enforcement of anti-pollution regulations

Table 2 (continued)

	Manifestations	Impacts	Direct causes	Underlying causes
COASTAL ZONE	Coastal zone degradation	Deteriorating quality of urban life Destruction of coastal ecosystems Reduced/lost recreational value	Overcrowding Poor land-use planning & enforcement; haphazard development Urban & industrial concentration	Population pressure Incompatibility of multiple resources uses Ineffective land markets Inappropriate land values/externalities Absence of multiple use planning and enforcement Absent/ineffective regulatory & enforcement mechanisms
	Urban degradation & squalor	Health impact Degradation of built-up environment & physical infrastructure investments	Overcrowding Lack of urban planning Lack of infrastructure & services	Population pressure Ineffective land-use planning Rural deprivation & "land flight" Urban poverty Absent/ineffective regulatory & enforcement mechanisms
	Solid wastes	Health hazards Visual & olfactory pollution Blockage of watercourses and drains Lagoon/wetlands effect	Lack of effective collection and disposal systems	
	Lagoon & coastal water pollution	Health impact Reduced/lost recreational value Fisheries depletion & reduced fish catch Eutrophication	Uncontrolled urban & industrial waste, effluent and raw sewage discharge Absent/poor sanitation & waste treatment systems Coastal shipping & oil spills	Absent/ineffective regulatory & enforcement mechanisms Perception of "free good" ("open access" syndrome)
	Coastal wetlands ecosystems degradation/loss	Loss of habitat & biodiversity Species extinction	Pollution, siltation Changes in hydrological systems Changes in fresh/saline water balances Dam/reservoir construction Infrastructure & industrial development	Population pressure Value perception (severe externalities)
	Coastal erosion	Loss of land, physical infrastructure, historical and touristic sites	Wave & oceanic current action Changes in hydrological regimes through draining of rivers & coastal zone civil works	
	Marine resource depletion	Reduced fish catch	Overexploitation	Ineffective enforcement Perception of "free good" ("open access syndrome)
OTHER	Air & atmospheric pollution	Health impact Global warming Acid rain	Bushfires Burning of fossil fuels Industrial & mining emissions Vehicle emissions Dust from industrial, mining & quarrying activities Dust from land stripped of plant cover	Lack of standards, regulations, enforcement Perception of "free good" ("open access" syndrome)
	Hazardous wastes	Health impact, often with long time lag	Industrial & mining processes Agricultural chemicals Toxic household wastes	Lack of standards, regulations, enforcement Industrial pricing
	Degradation of cultural property	Loss of cultural heritage Loss of tourism revenue	Lack of public awareness & effective protection	Short-term value less than long-term value Lack of enforcement

country's industrial establishments are located in the Accra-Tema area. There is only limited capacity to cope with the human and industrial wastes generated in this area, constituting a threat to the fragile coastal ecosystems. Of particular importance is the impact of development on the coastal wetlands, a series of lagoon areas which provide unique ecological conditions and habitats for large populations of migratory waterfowl. Exploitation of marine fish resources also impacts on the coastal zone, most directly through the demand for fuel wood for artisanal fish-smoking enterprises that has led to extensive felling of trees in and beyond the coastal zone.

4. Mining and manufacturing industrial activities

34. Mining and manufacturing industrial activities have the potential to impact significantly on the country's environment if intervention measures are not taken. The quantity and diversity of industrial wastes have increased over the years, particularly in the Accra-Tema area. The significant increase in the number of surface mines can exacerbate the mining induced impacts.

35. The main industrial polluters are textiles, food and beverages, petroleum refining, and mineral exploitation and processing industries. The major air polluters are the aluminium smelter and alumina conveyance (fluorides, sulphur dioxide, alumina), mining companies calcining sulphide gold ores (arsenic trioxide, sulphur dioxide), the oil refinery (sulphur dioxide), cement and asbestos plants (asbestos particles and cement dust), the steel works (iron oxides), sawmills and wood-processing plants (dust). Major water polluters are the breweries, textile mills and mines.

5. Major causes of environmental degradation

36. Many of the direct causes of environmental degradation are given in table 2. These are well known and do not merit detailed discussion. What is often overlooked are the underlying causes. There are commonly complex interrelationships between the direct causes, which are often the result of equally complex linkages between underlying factors and forces. It is generally accepted in Ghana that the main underlying causes may be categorized to include: (i) population; (ii) poverty, income distribution and gender issues; (iii) land tenure; (iv) land management; and (v) other factors.

Population

37. The needs of Ghana's rapidly expanding population have been met largely by unsustainable exploitation of the available and accessible natural resources. This is reflected both in the shortened fallow periods and expansion into previously uncultivated areas. The problems caused by the rapid growth in total population are exacerbated by its uneven distribution within rural areas and by concentration through rural-urban migration. Over half the population lives in the Greater Accra, Eastern, Central and Ashanti Regions, though there are densely settled areas in the Upper East and Volta Regions. It is in such areas

that population pressure is taxing the resiliency of the environment as traditional systems of sustainable resource use break down. The rapid increase in the population of urban areas, in which the development of urban infrastructure has been inadequate, has also led to pollution and degradation of the urban environment.

Poverty, income distribution and gender issues

38. About half the population of Ghana is estimated to live in absolute poverty, and two thirds live in households in which the per capita consumption is less than 60 per cent of the national average(1). As is well known, poverty is an impediment to adopting new practices or products that may be less damaging to the environment. Investing in conservation, whether it be planting a tree rather than cutting one for fuel wood, or adopting improved land management practices to maintain soil fertility, requires investments in capital or labour which the poor may not be able to make. A skewed income distribution, in which the wealthy are more able to make such investments or to secure services, means that the poor are more likely to continue to exploit the available resources in an unsustainable manner.

39. A majority of farmers in Ghana are women, who account for about 70 per cent of food crop production. Over half the adults in the agricultural labour force are women. Working-age men continue to leave their villages to look for work in urban areas, or to establish cocoa farms elsewhere, leaving women to manage farms on their own. Facing severe constraints of labour, credit and access to improved technology, women have little choice but to continue with low-input traditional farming systems, which, as the fallow period decreases, are not sustainable in the long term and lead to severe land degradation.

Land tenure

40. An important aspect of the traditional tenurial systems is that no adult member of the community can be denied the right to clear land for farming that has not been assigned to another member of the community. Following very rapid population growth, this has been a major cause of rapid deforestation and subsequent degradation. Increasing rural-rural migration also means that there is an increasing number of "strangers"; who may be permitted to farm community land, but who have no long-term rights of ownership and hence no incentive to conserve land resources. This is further accentuated by the fact that "strangers" rarely have the right to plant trees, and if they do plant them, often have difficulty in transferring their ownership to family members. In addition, de facto open-access conditions have replaced the traditional arrangements for management of common property. For example, members of a community could hunt freely within the community land, but strangers had to be accompanied by a community member and make payment in kind to the local chief. The breakdown of this system has led to unregulated hunting, over-exploitation of the wildlife resources and commonly the destruction of wildlife habitats. Perceptions of resources, such as water, grazing and forest products, as free goods is a major underlying cause of pollution and resource degradation.

Land management policies

41. Effective management of land is dependent on policies related to the allocation of land between major uses or sectors, and the manner in which land is exploited within its allocated sector. The critical importance of land-use planning has long been recognized in Ghana, and the Government established a Land Use Planning Committee in 1978. Although the Government, through the Lands Commission, has control of land allocation, there is no overall policy and more than two dozen departments and agencies are involved in various aspects of land management. The lack of adequate national or local land-use planning capabilities, compounded by the lack of an up-do-date assessment of land suitability, is most readily apparent in the coastal zone, where incompatible land uses often compete with each other. It is also apparent in the rapid settlement and clearing of remaining forested areas without regard for their suitability for farming.

Other factors

42. A number of other factors contribute to the underlying causes of environmental degradation. They include institutional weaknesses and limited public awareness of environmental issues. Lack of understanding of the adverse effects of production systems or consumption patterns limits the development of popular demand for environmental protection and benign technologies.

B. Mining and mineral processing

43. Mining and mineral processing can cause serious conservation problems if not properly controlled. The main environmental problems identified with mining and processing in Ghana are water pollution, land degradation, aerial pollution and socioeconomic problems. Surface and underground mining methods are currently in use. However, there has been a significant increase in the number of surface mines since 1986. All the 12 mines that started operations since then have been surface operations.

1. Impact of mining

44. The main environmental impacts of mining in Ghana, particularly surface mining, may be classified as follows (2):

- water quality (emissions to surface and groundwater);
- land degradation (including effects on soil quality, etc.);
- land-use conflicts;
- visual intrusion (including effects on the landscape, etc.);

- emissions to the atmosphere; and
- socioeconomic.

Water quality

45. Mine-imposed sediment loading of natural drainages is the most significant and pervasive physical environmental impact from mining in Ghana. Fine sediments are introduced into local drainages, mainly through water erosion of exposed unconsolidated material and occasional breaches of old tailings dams. Preliminary field investigations have shown that at all the new mines the local population complained of sediment-contaminated water supplies and that downstream water had been rendered unsuitable for drinking and other domestic water uses. Water pollution from heavy metals is being caused by the in-river disposal of untreated metallic mining/processing effluents and the fallout from arsenic trioxide emissions following the calcination of sulphide ores.

46. The three main sources of aqueous wastes associated with mining, in general, are: (a) mill process wastes; (b) mine drainage water; and (c) contaminated surface drainage. Potential sources of pollution for contaminated surface drainage include areas around ore-handling facilities, the mill, haul roads and waste rock piles, and seepage and erosion from tailings impoundments and settlement ponds.

Land degradation

47. As noted above, land degradation is a serious problem in the country. The deterioration usually begins with the removal of the vegetation cover. Once the plant cover is disturbed, soil degradation occurs in the form of accelerated water erosion, soil compaction or surface soil crusting with a resultant loss of soil fertility. Thus, badly controlled mining methods can destroy soil and living resources leaving behind a barren, denuded and eroded wasteland.

48. Pollution of land may result from fallout of toxic dust, from contaminated mine water or from flooding of land by polluted streams. Death of vegetation, crops and livestock can result and the effects on public health can also be serious.

Land use

49. Mining and processing lead to land alienation. It was estimated in 1990 that 1,166 square kilometers of land (0.5 per cent of the country's total area) had been alienated by industrial mining. The total disturbance to land due to the direct effects of mining was approximately 60 square kilometers, assuming that each of the new mines was fully developed. It is well known that minerals are mined where they are found; there is rarely any choice in site selection. Hence, competing claims on land-use have emerged and are likely to become even more serious in the future. The situation is exacerbated by the lack of adequate national or local land-use planning capability. However, there are national plans to address these issues. Meanwhile, no new mining licenses will be granted to companies to operate in forest and/or

wildlife reserves.

Land subsidence

50. Land subsidence occasionally occurs in old underground mining areas. The latest occurrence (in 1992) was at Tarkwa Goldfields Limited and was widely reported in the national press. However, the major concerns of underground mining in Ghana are the health and safety hazards to miners.

Emissions to the atmosphere

51. Aerial pollution from mining mainly results from dust arising from the operations. The major sources of dust pollution include drilling, blasting, loading and unloading, mobile equipment (exhaust emissions, blasting frames, etc.) and general dust blow. Metal mining, in particular, can cause local problems of dust blow and toxic particle deposition. Since the dust may contain metallic compounds, widespread contamination of land and water courses can result. All dust, whether toxic or not, has been found to present a serious nuisance to the nearby communities and has damaging effects on vegetation, blocking plant pores and reducing light penetration and photosynthesis.

Visual intrusion

52. The sources of visual intrusion include pit faces and floors, waste disposal areas, stockpiles, fixed plant and buildings, rail and access points and dust plumes. Most of the major gold mines in Ghana were underground operations until the recent past. Since 1986, all the new mines are surface operations and this problem is therefore likely to assume serious dimensions if the necessary steps are not taken.

Noise and vibration

53. Noise levels outside the mine site give rise to nuisance to people living nearby. The sources of noise and vibrations at the mines include air blasts, blasting vibrations, mobile equipment noise, fixed plant noise, etc. Noise and vibrations arising from blasting at some of the surface mines are causing concern. This is particularly true at some of the new mines where the local population, not being used to such sharp noises, is justifiably worried.

Socioeconomic impacts

54. In the past, most of the old mines in Ghana neglected their social obligations. Social issues were largely ignored and the attitude of the mining companies towards the local population was patronizing.

55. The direct negative socioeconomic and cultural impacts of mining are severe in some cases, and tend to be concentrated in small areas directly adjacent to mining projects. However, the positive benefits derived from mining tend to be far more widespread. Generally, the investing companies and central Government are the principal economic beneficiaries. In contrast, the physical environmental effects of mining tend to be highly localized, with the local people bearing the brunt of the hardships.

56. A survey in the country in 1990 showed that the socioeconomic impact of industrial mining generally varied according to whether the mine was an older (pre-1986) established mine or a new mine. The findings and implications of this survey are summarized in the following.

57. Traditionally, the older mines have been labour intensive. In spite of the fact there have been some retrenchments at the various mines since 1984, the workforce of the smallest old mine was found to be larger than that of the biggest new mine.

58. In almost all instances, the original local population in a mine project area was neither sufficiently large nor did it possess a full range of required mining skills, nor, more importantly, was it especially anxious to substitute its economic activities for mining work. Consequently, the mining companies drew in workers from other parts of the country and from beyond its borders.

59. While a full set of historic wage levels was not available during the study, it was discernible that mining wage levels were significantly lower than the overall average in Ghana until 1969. However, by the mid-1970s, this trend had reversed and mine workers were relatively better paid. It therefore seems reasonable to assume that the relatively low cash wages in mining before 1970, and especially in colonial times, served as a disincentive for the local people to work in the mines and increased the need to draw in migrants.

60. However, the fact that the bulk of the workforce was migrant meant that while wage costs might have been low, non-wage labour costs in the form of accommodation and service provision for labour were created. A feature of every old mine in Ghana is the extensive urban facilities that each has built up over the years: worker compounds, water and domestic waste disposal systems, health services, bungalows on hilltops, club buildings, swimming pools, tennis courts, etc.

61. Many of these services impacted on the surrounding population. Company health services were normally expected to be available, at a subsidized charge, to non-company personnel. Employees' food and other needs led to the local growth of markets and other businesses. Railways and roads built to service mines broadened accessibility and improved mobility for all, allowing greater potential for cultivation of cash crops. The larger the labour force, the greater were such spillover impacts, many of

them advantageous, or at least not wholly negative to local people.

62. In a nutshell, mining in Ghana has been associated with large, ethnically mixed labour forces and the development of a wide range of services of an urban type for workers, some of which have spilled over for use by the local community.

63. Two other features of the colonially introduced mining system are of obvious significance. First, for many years, both formal royalties and informal payments (and in some cases rental payments) were made by companies to the chiefs who controlled the land in mining areas. These payments reinforced the political as well as the economic status of chiefs and also served as compensatory devices for loss of land and amenity. However, these payments legally ceased to be payable to chiefs with the introduction of the Minerals Act of 1962. Secondly, concessions were, in many cases, granted for very large areas of land. Of the old mines, Awaso was the exception to this rule. Since only small portions of the concession were ever mined at one time and the concessionaire effectively controlled land use in the area, exploration tended to continue in parallel with mining. Consequently, long-range planning became difficult since at no stage could a company say with certainty which areas in its concession would or would not at any stage be subject to mining.

2. Impact of mineral processing

64. The impacts of gold processing in Ghana the country include the following:

- air pollution
- water pollution
- land pollution
- land-use conflicts
- noise
- visual intrusion
- socioeconomic dislocation

65. The major impacts are air and water pollution. Details on the last five factors mentioned are similar to those for mining in general and so will not be discussed further.

Air pollution

66. The common forms of air pollutants associated with processing are sulphur dioxide, nitrogen oxides and particulates (smoke and dust). The other air pollutant associated with the processing of the country's gold sulphide complex is arsenic trioxide. Two of the country's three mines processing gold-sulphide complex ores have installed baghouse filters to remove arsenic trioxide. However, emissions of sulphur dioxide are still uncontrolled.

67. The oxides of nitrogen and sulphur affect both the environment (largely as precursors of acid deposition and photochemical oxidants) and human health, as notable respiratory irritants. Arsenic trioxide and sodium arsenite are considered poisonous. Arsenic trioxide is a known carcinogen. Arsenic trioxide and sulphur dioxide also stultify plant growth, as evidenced by the severe degradation of vegetation near the roaster stacks of Ashanti Goldfields Corporation and Prestea Goldfields Limited.

Water pollution

68. The main potential water pollutants from the gold-processing plants are heavy metals such as copper, zinc, lead, manganese and mercury. Other identifiable pollutants include high levels of total dissolved solids and/or suspended solids. Spilled oil may also pose problems, but this is not common in the country's mines.

69. As already stated, water pollution is currently the most troublesome impact of gold mining in Ghana. Gold mine effluents consist of a complex of chemicals, many of which have deleterious effects on aquatic life, irrigation water and drinking water. Both man and animals can be seriously, and indeed fatally, affected by pollution from these sources, particularly by heavy metal contamination of drinking water.

70. Extensive pollution by heavy metals can affect man through contamination of drinking water or by metals passed through the food-chain to crops, vegetables or animals used for human consumption. From the viewpoint of human health, the most toxic, commonly occurring metals are arsenic, lead and mercury. Mercury is toxic to man and is associated with disorders of the nervous system. Other reported effects on man include loss of hair, teeth, etc. The toxicity of arsenic is related to its valency. Arsenic (III) is considered most toxic.

71. Organic reagents commonly used to process minerals and which occur in mine effluents are not hazardous, mainly because of the low concentration levels that occur in the effluents. The chemicals are generally biodegradable. However, at higher concentration levels, most of these chemicals are toxic.

72. The most toxic chemical used in the treatment of auriferous ore in Ghana is cyanide. Although cyanide is naturally degradable, extensive damage can be caused to fauna and even humans if adequate measures are not taken. Companies in Ghana are therefore taking elaborate measures to render their spent cyanide solutions innocuous before discharging them into the environment.

3. Socioeconomic implications of structural change

73. Of the older mines surveyed, Dunkwa, Tarkwa, Prestea and Akwatia were in difficult economic circumstances in late 1990. The recovery of Awaso from a similar situation in 1984 to a position of health in 1990 is an encouraging sign. To some degree, all of the mines can point to assessments which give

some hope for the future. Nevertheless, all of them have retrenched workers in recent years, including the more profitable mines such as Obuasi. One reason for this is that direct wage costs in the mining industry relative to national wage costs in Ghana have moved from slightly below average in the 1960s to well above average by the late 1970s; by 1987, according to the Ghana Statistical Service, mining wages were almost 75 per cent higher than the average. This transition occurred at exactly the period of the mining industry's biggest recession. Because of the declining labour force and unsatisfactory profitability, the older mining companies can no longer afford to provide many of the traditional services for workers.

74. All new mines, except Kwabeng's alluvial operations, involve open pit mining of low-grade surface gold deposits. Given the generally large extent of open pits and waste dumps, the total land requirements of the new mines are usually significantly greater than those of older mines. Thus, impact on other users of the land is proportionally much larger as well.

75. This change raises two major issues which have not been of particular importance in the past:

- loss of alternative revenues from land used by mining;
- the adequacy of levels of compensation.

76. Of the new mines, only Konongo employs more than 500 persons. Annual planned production values of Konongo, Sansu, Teberebie, Bogosu and Kwabeng are estimated to total close to US$160 million. Yet this will be produced by fewer than 2,000 workers. Estimates have shown that the new mines will have a production value per employee more than seven times greater than the older mines. The principal implication, therefore, is that the new mines will not be major employers; the benefits from new mines to Ghana is not expected to include a major employment component. While Konongo is using the housing it inherited for its workers, and Bogosu and Sansu are building housing for their junior staff, housing will not be provided for workers on daily rates, who compose, by far, the largest number of employees. Thus, part of the traditional costs of labour in Ghanaian mining will not be taken on by most of the newer mines, even if some, like Bogosu, are paying higher than average cash wages. The whole array of impacts, both positive and negative, arising from the employment of a large workforce will be severely reduced in the case of new mines.

77. One school of thought believes that if Ghana is to gain benefits from the new mining activities, these benefits should be in the form of direct taxes on production and of dividend payments, rather than in indirect ways or in employment. However, since the former type of benefits tend to be highly centralized, while the latter are more diffuse and have local impacts, the implication is that the Government, should it wish to ensure that benefits accrue to areas impacted by new mining, will need to consider more closely such factors as:

- provision of local infrastructure from central funds;
- how the limited opportunities for mining employment are distributed, and what training procedures are proposed;
- investment of central revenue, in forms of development other than mining in mining areas;

These are some of the main reasons why the Minerals Development Fund concept was introduced (see section III.C).

78. Women rarely make up more than 5 per cent of a mine's labour force. Some decades ago, mines provided accommodation designed only for single men, except for senior staff. Since most employees were migrants, wives and children were either left behind in villages or lived in the mine quarters intended for the single men. If left behind in the villages, the burden of farm management and rearing a family fell almost wholly on the women; if the women lived in the mine quarters, they found that housing conditions were cramped, they almost never found employment other than that which they created for themselves (mainly as petty traders) and that they had to adjust to an alien environment, in their case without the support of an occupational status. These unfavourable conditions for women are, of course, by no means unique to Ghana. They are also a source of concern, for example, in nations as diverse as Australia and Canada on the one hand, and southern Africa or Papua New Guinea on the other. In the former countries, the introduction of commuter mining, where workers spend a week or two at the mining site and then a week or two at home in an established town where their families reside, has apparently considerably reduced the hardship imposed on wives (3).

79. To some degree, therefore, the fact that the new mines in Ghana have lower labour requirements means that fewer wives will be faced with the difficult choice of staying behind or joining their husbands. The fact that most new mining companies have deliberately chosen not to provide worker housing means that wives will have to remain at home.

III. GOVERNMENT POLICIES

A. General

80. During the British colonial administration in Ghana, i.e. before 1957, environmental management was largely ignored. The economic policies adopted at the time essentially involved the maximum exploitation of resources with minimum inputs. Laws were therefore passed to protect these resources; i.e. mining, rivers and other water bodies, forest and savannah vegetation, wildlife and urban land use. Serious environmental problems, such as air and water pollution in the mining areas, deforestation and soil degradation, which were compounded by increased production, received very little attention. Within its administrative systems, the British administration maintained ministries or departments responsible for dealing with environmental matters such as sanitation, public health, public works and housing, and social welfare and community development. After independence, even though most of the various government ministries and departments continued to exist, a number of problems relating to the environment never received the attention they deserved.

81. The environmental cost arising from developmental efforts has been high, particularly in some parts of the country that have fragile ecosystems. For this reason and because of the severe droughts in Ghana during the late 1970s and early 1980s, as well as the extensive bush fires of 1983-1984, public awareness of environmental issues increased and led the Government to intensify its efforts to establish environmental policies. In 1987, work was started on a National Conservation Strategy. A draft National Environmental Protection Programme was also prepared in 1987 based on priorities identified through a series of regional and district forums organized in 1986 and 1987. These activities culminated in a government directive to the Environmental Protection Council (EPC) to coordinate the preparation of a National Environmental Action Plan (NEAP) and a National Environmental Policy (NEP). Seven expert committees were formed by the EPC in July 1988 to assist with the development of the NEAP in order to put in place a comprehensive and integrated national strategy. The identified environmental concerns of the country, which were the subject of six of the expert groups, were categorized as follows:

- Land management;
- Water management;
- Mining, manufacturing industries and hazardous chemicals;
- Forestry and wildlife;
- Marine and coastal ecosystems;
- Human settlements.

The seventh group adressed legal and institutional issues, cross-sectoral issues, environmental education and environmental data systems and monitoring (4).

82. The preparation of the NEAP involved a wide range of participants from government agencies, universities/research institutes, NGOs, the private sector and the general public (largely represented by the

district assemblies). The NEAP and NEP have since been approved by the Government. More importantly, a Ghana Environmental Resource Management Project (GERMP) has been formulated to operationalize NEAP over the next five years. GERMP, which was launched in early 1993, is to support the implementation of the 10 year NEAP (1991-2000) over the five years 1993-1998. In February 1993, the Government also created a new Ministry of the

Environment, to be responsible for environmental policy development and coordination of environmental planning and management.

B. National environmental policy

83. The EPC was established by the Ghanaian Government in 1973 following the 1972 Stockholm conference on the Human Environment, to address problems relating to development and the environment. Some of the main functions of the EPC are:

- to coordinate the activities of all bodies concerned with environmental matters;
- to conduct and promote research, studies and surveys relating to the improvement of Ghana's environment and the maintenance of sound ecological systems; and
- to serve as the official national body for cooperating with international organizations on environmental matters.

84. The key elements of Ghana's response to the environment and development issues include:

- the setting up of a Ministry of the Environment;
- initiation of principles, policy guidelines, key goals and priorities of development in relation to environmental sustainability;
- development and implementation of specific approaches to address the problems of the integration between development and the environment;
- initiation of programmes and projects for sound development and environmental sustainability.

85. The principles adopted by the Government include the following:

- optimum sustainable yield in the use of resources and ecosystem;
- use of the most cost-effective means to achieve environmental objectives;
- delegation of decision-making and action to the most appropriate level of government;
- polluter pays for the cost of preventing and eliminating pollution and nuisances;
- public participation in environmental decision-making and action;
- use of incentives in addition to regulatory measures;
- international cooperation.

86. The ultimate aim of the National Environmental Policy of Ghana is to improve the surroundings, the living conditions and the quality of life of the entire citizenry, both present and future. It seeks to ensure reconciliation between economic development and natural resource conservation, to make a high-quality environment a key element supporting the country's economic and social development. Specifically, the policy seeks to:

- maintain ecosystems and ecological processes essential for the functioning of the biosphere;
- ensure sound management of natural resources and the environment;
- adequately protect humans, animals and plants, their biological communities and habitats against harmful impacts and destructive practices, and preserve biological diversity;

- guide development in accordance with quality requirements to prevent, reduce, and as far as possible, eliminate pollution and nuisances;
- integrate environmental considerations in sectoral structural and socioeconomic planning at the national, regional, district and grassroots levels;
- seek common solutions to environmental problems in West Africa, Africa and the world at large.

87. Environmental protection in Ghana is guided by the preventive approach, that is, with the recognition that socioeconomic developments must be undertaken in such a way as to avoid the creation of environmental problems. Specifically, the Government will:

- commit itself to the environmentally sound use of both renewable and non-renewable resources in the process of national development;
- create awareness among all sections of the community of the environment and its relationship to socioeconomic development, and of the necessity for rational resource use among all sectors of the country;
- develop procedures for the utilization of land resources in a manner that will ensure the maximum degree of economy in the use of land and avoid or minimize conflicts;
- institute and implement an environmental quality-control programme by requiring prior environmental impact assessments of all new investments that would be deemed to affect the quality of the environment; take appropriate measures, irrespective of the existing levels of environmental pollution and extent of degradation, to control pollution and the importation and use of potentially toxic chemicals;
- take appropriate measures to protect critical ecosystems, including the flora and fauna they contain against harmful effects, nuisance or destructive practices;
- develop and maintain a professional cadre within the country to supervise, coordinate, implement and enforce procedures and legislation essential for safeguarding the environment and maintenance of sound ecological systems;
- oblige all concerned to provide the appropriate agencies with the relevant information needed for environmental protection and for the enforcement of relevant environmental regulations and legislation;

- promote and support research programmes aimed at better understanding of the different ecozones and the factors affecting them, as well as health-related environmental problems, and the development of appropriate technologies for environmentally sound management and use of local resources, including renewable energy resources;
- establish an adequate legislative and institutional framework for monitoring, coordinating and enforcing environmental matters.

88. The fundamental aims of the National Environmental Policy will be pursued and achieved through the harmonization and enforcement of relevant laws and treaties on the environment, and the implementation of an Environmental Action Plan. The Plan is intended to provide a coherent framework for the various interventions necessary to safeguard the environment.

C. Policy and strategies in the mineral sector

1. General

89. The policy for mineral development in Ghana may be subdivided into three elements: (a) national sovereignty over mineral resources, (b) economic growth and development: and (c) mineral conservation. These, inter alia, are stipulated and elaborated on in the Minerals and Mining Law, 1986 (PNDCL153), and the Mining Regulations, 1970 (LI665).

90. National sovereignty over mineral resources is generally accepted. With regard to economic growth and development, the mineral strategy adopted is meant to ensure both that mineral-resources exploitation provides the country with an equitable share of the revenue from such activities and that investors receive a fair return on their investment (5).

91. The importance of reinvesting revenues from mineral resources to sustain economic growth and development can hardly be overemphasized because mineral resources are non-renewable assets. A larger percentage of government revenues from minerals exploitation is best channelled into continuing investment in the industry (e.g. geological mapping by the Geological Survey Department), agriculture and supporting infrastructure development in the country. A new policy goal of the Government is using mining as a "vehicle" for rural development, where possible. This has led to the legalization of small-scale gold mining in 1989 and the concept of the "Mineral Development Fund".

92. The Mineral Development Fund (MDF) is a special consolidated fund set up by the Government to: (a) alleviate some of the environmental problems affecting the local population as a result of the mining activities; and (b) finance institutions in the minerals sector (such as the Minerals Commission,

Mines Department and Geological Survey Department) and special mining and mineral processing related projects. Twenty per cent of every royalty payment is paid into the MDF. Half of the amount paid is re-cycled to the district(s), where the mine is located, for development (mainly infrastructural) projects in that district(s).

93. One of the indicators of a country's degree of industrialization is its consumption pattern for industrial minerals. In developed industrialized countries, vast quantities of industrial minerals are utilized. In Ghana, however, the industrial mineral sector is largely undeveloped. It is well known that the exploitation of industrial minerals promotes more linkages in the local economy (particularly in developing countries) than the winning of metallic minerals. Concerted effort is therefore being made to develop the industrial minerals sector in the country. This is particularly true for common salt where elaborate plans have been made to develop the country's vast potential.

94. As indicated above, one of the main policy goals is the conservation of the country's mineral resources through their efficient exploration and exploitation in an environmentally sustainable manner. Provisions have been made in the minerals code, prospecting license and mining lease agreements to facilitate this policy goal. The strategy for the development of the mineral sector has been based on a mixed system involving technical, financial, marketing and social considerations. Various mineral-sector specific strategies and/or measures have been taken. However, the most important measures taken by the Government are the promulgation of the Minerals and Mining Law in 1986 and the setting up of the Minerals Commission, also in 1986. The Commission is responsible for the regulation and management of the utilization of the mineral resources of Ghana and for the coordination of the policies in relation to them. The Commission has the mandate to ensure the sustainable development of the minerals sector and also to act as a "one-stop mining investment centre". The streamlining of the procedure for approval of license/lease applications has also been a catalyst for the gold investment "boom" in the country since the inception of the Commission.

2. Existing environmental regulatory system

Legislation

95. The laws and regulations under which the mining industry operates are listed below. Two enactments (PNDCL.153 and LI665) currently regulate the environmental aspects of mining directly.

Laws

- Minerals and Mining Law, 1986 (PNDCL 153)
- Minerals Commission Act, 1993 (Act 450; formerly PNDCL153);
- Small Scale Gold Mining Law, 1989 (PNDCL 218)
- Diamonds (Amendment) Law, 1989 (PNDCL 216)
- Mercury Law, 1989 (PNDCL 217)
- Environmental Protection Council Decree, 1974 (NRCD239)

- Precious Minerals Marketing Corporation Law, 1989 (PNDCL 219)
- Diamonds Decree, 1972 (NRCD 32)
- Additional Profit Tax Law, 1985

Regulations

- Mining Regulations, 1970 (LI 665)
- Explosives Regulations, 1970
- Minerals (Royalties) Regulations, 1987.

96. For many years, the Mineral Ordinance, 1936 (Cap 185) and the Minerals Act, 1962 (Act 126) and the various amendments made to them were the major laws regulating the mining industry in Ghana. None of the laws contained any provisions significantly regulating pollution (6). However, the Mining Regulations 1970 (LI 665) as amended by L.I. 689 made under section II of the Mining Rights Regulation Ordinance, Cap 153 (1951 Rev) included provisions dealing with workers' protection and air quality during mining operations. The Mining Health Area Ordinance Cap 150 regulated health and sanitation in the mining areas. Apart from these few provisions there were no laws seeking to ensure that mining activities did not result in the degradation of the environment.

97. The Minerals and Mining Law of 1986, PNDCL 153 which superseded all the previous legislation goes a long way in seeking to protect the environment. Section 72 of PNDCL 153 provides that:

> "The holder of a mineral right shall in the exercise of his rights under the license or lease have due regard to the effect of the mineral operations on the environment and shall take such steps as may be necessary to prevent pollution of the environment as a result of such mineral operation."

98. This provision presupposes that the licensee is required to know in advance the likely consequences of his activities. Consequently, the absence of a requirement for filing an environmental impact assessment before the commencement of mining operations was recognized as an obvious gap. This was rectified through an administrative directive by the Government in 1989 pending the enactment of the Environmental Protection Act, which at the time of writing was under preparation.

Mining Regulations

99. The only relevant provision of the Mining Regulations for the purposes of this discussion is Regulation 44 which requires water containing poisonous or injurious chemicals to be fenced off and prohibits such water being permitted to escape without its having been made safe. The other environmental provisions in the regulations relate to the immediate working environment.

Prospecting Licenses

100. Clause 4 of the Prospecting Licenses requires prospecting companies to:

> "... conduct all [their] operations ... with due diligence, efficiency and economy to the maximum extent possible consistent with good mining industry practice and in a proper workmanlike manner observing sound technical and engineering principles and practices, using appropriate modern and effective equipment, machinery, materials and methods and to pay particular regard to environmental protection."

Mining Leases

101. Mining Leases contain a few more provisions on environmental management. The first is Clause 5(a), the wording of which is almost identical to that of Clause 4 of the Prospecting License quoted above. Other provisions relating to environmental management are Clause 8 (b), which requires the company to take all necessary steps to prevent undue pollution of rivers and other potable waters and to ensure that such pollution does not cause harm to human life or to flora and fauna, and Clause 29 (e), which requires the company on termination or expiry of the lease to leave the area in good condition, having regard to ecology, drainage, reclamation, environmental protection and safety.

Enforcement Mechanisms and Sanctions

102. Under the terms of Prospecting Licenses and Law 153, a prospecting company which fails to remedy bad environmental practices, could, after it has been given notice, have its license terminated. In the case of mining companies, the Chief Inspector of Mines is empowered under the terms of the lease to effect appropriate measures in the event of the failure of the company to comply with environmental requirements and to recover the cost of such action from the company. Provision is also made for the termination of the lease - a power which has so far not been exercised, and which would probably only be exercised after persistent and wilful non-performance. Section 80(1)(f) of the Minerals and Mining Law makes pollution of the environment an offence. Where the offence is committed by a corporate body Section 81(1)(a) provides:

> "... every director or an officer of the body shall also be deemed to be guilty of the offence".

103. Thus directors and other officers of companies could be held to be personally liable for the environmental offences of companies. However, under Section 81(2):

> "No person shall be deemed to be guilty of an offence by virtue of subsection (1) of this section if he proves that the offence was committed without his knowledge or connivance and that he exercised all due care and diligence to prevent the commission of the offence having regard to all the circumstances".

104. Penalties which may be imposed for offences under the Law are specified in section 82 and

include a fine which may be accompanied by imprisonment of up to two years. According to Mate (6), individuals and communities whose persons and property have been injured by the bad environmental practices of mining companies can also take civil action in the courts to seek redress.

3. Environmental guidelines for the mining industry

105. A review of the mining legislation during the preparation of the National Environmental Action Plan showed that an omnibus provision had been made in the existing law for environmental protection. However, controls of the environmental impact of mining are not specified in the Minerals and Mining Law. Also there is no mention made of solid, atmospheric, liquid waste and the reclamation of mined-out lands.

106. Section 83 of the Minerals and Mining Law empowers the Secretary for Lands and Natural Resources "to make regulations for the conservation and development of mines and minerals" by Legislative Instrument. In accordance with this provision in the law, the then Ministry of Lands and Natural Resources asked the Minerals Commission to coordinate a study funded by the World Bank on "the effect of mining on Ghana's environment". The main aim of the study was to formulate environmental guidelines to be used in drafting regulations for controlling the activities of mining companies.

107. The environmental study culminated in the provision of baseline information on all the large mines operating in the country and the formulation of draft guidelines in 1991. A national seminar was held in June 1992 to discuss the guidelines. The participants included representatives from the mining companies, NGOs, government agencies, universities and research institutes and the general public. Based on the interventions and contributions and subsequent written comments from the mining companies, the draft environmental guidelines were reviewed and finalized during the latter part of 1992.

108. The guidelines are divided into three parts:

(a) general guidelines for exploration, mining and mineral processing and decommissioning;
(b) detailed guidelines for the preparation of an Environmental Impact Assessment (EIA) for a new mining project; and
(c) detailed guidelines for the preparation of an Environmental Action Plan (EAP) for existing mines.

109. The guiding principles used in the preparation of the guidelines were:

- all mining causes environmental impact;
- environmental impact can be minimized by planning, design and management;
- balance is required between the minimization of environmental impact and the need for mining to contribute to Ghana's economic growth and exports;

- the approach to minimizing environmental impact should be hierarchical, determined by technical feasibility, cost and benefit;

    - first, pre-emption of the impact;
    - second, containment of the impact;
    - third, compensation for and/or replacement of resources; and
    - fourth, progressive reclamation of disturbed land.

110. As stated earlier, the guidelines cover the main aspects of environmental management in the mining industry. The details fall outside the scope of this report. However, the reporting requirements for EIA, EAP and Annual Reporting are noteworthy and are as follows:

Requirements for Environmental Impact Assessment (EIA)

- Any company proposing to develop a mining project that will affect an area of the land surface greater than 25 acres (10 hectares) shall submit an EIA.
- A company shall honour all commitments made in the EIA, except where written permission is given by EPC.
- If a project's EIA has been approved, but changes are contemplated that will significantly modify the expected impact of the project, then the company shall submit a supplement to the EIA describing those changes and their expected environmental effects.

Requirements for Environmental Action Plan (EAP)

- All existing mining operations shall submit an EAP every two years. The Plan shall cover five years and shall comprise a two year EAP and a three-year rolling plan for the subsequent years.
- A company shall honour all commitments made in the EAP except where written permission has been given for modification by the EPC in the light of new field evidence.
- New mining companies shall submit EAP as part of the EIA.

Requirements for Annual Reporting

- Companies shall submit an annual environmental report at the end of each calendar year. The contents of each report will be agreed between the Government and the company.
- Companies shall submit copies of environmental audit report(s) undertaken to the Minerals Commission, EPC and Mines Department. Such reports will be kept confidential and shall not be in the public domain.

111. It is worth noting that through an administrative directive, mines constructed since 1989 have had to submit EIAs to the Government as part of the prerequisites for mining lease approval. In contrast, manufacturing industries are already required by law to submit EIAs prior to licensing.

112. One of the main outputs of the earlier study on "the effect of mining on Ghana's environment" was the establishment of the need and scope for an EIA of small-scale mines. The aim of the study was to collect and collate baseline information with the view to drafting guidelines to control the activities of small-scale mining operators. This is a very complex subject and therefore emphasis has been placed on socioeconomic issues.

113. The EIA project started in December 1992. It is widely expected that the current study will form the basis for a comprehensive approach towards a more sustainable development in this sector. Environmental management in the small-scale mining sector should not be rule oriented and it is expected that proposed pilot studies will provide the necessary background information for the country-wide extension services and intervention measures envisaged for the mid-1990s.

D. Institutional issues

114. The overall responsibility for the management of Ghana's environment was transferred from EPC to the new Ministry of the Environment set up by the Government in 1993. It is expected that EPC will be restructured. However, EPC is likely to maintain some of the defined functions in the NEAP (notably assessment of EIAs, regular monitoring of environmental quality, environmental education and law enforcement). It is recognized that EPC can only fulfil this role with the cooperation of sectoral agencies responsible for implementation of programmes that affect the environment.

115. In the context of the NEAP, the Mines Department monitors and enforces the regulations concerning the working environment and within the mine "fence" while EPC monitors and enforces the regulations regarding the external environment. The Minerals Commission receives all EIAs, enquiries, etc. on mining environmental issues and forwards them to the appropriate government agencies, etc. The Commission continues to advise the mining public, formulate policies, plan and technically assist EPC and the Ministry of the Environment in their statutory functions with regard to mining and manufacturing industries.

116. An innovation in the management of the country's environmental resources has recently been introduced. District assemblies have been asked to be the "organ through which national policies and programmes on the environment will be translated into action at the local and district levels".

117. District Environmental Management Committees (DEMC) of the district assemblies will have the broad responsibility for monitoring and coordinating environmental protection and improvement activities in the district. The view held is that the general public is the best 'watchdog' of the environment if the appropriate measures are put in place.

E. Other issues

118. As mentioned above, an EIA is required before the start-up of a mining or mineral/metal processing project. The EIA should include baseline information, impact assessment, mitigation measures and environmental management/action plan. The baseline data generally cover land use, soils, fauna, flora, archaeology, water quality air quality, and socioeconomic issues. However, the actual extent of baseline information coverage should be based on the initial scoping done jointly by the mining companies and the Environmental Protection Council. Experience has shown that all the approximately 10 companies that have so far generated baseline data have covered all the aspects enumerated.

119. The mining companies are expected to predict the effect of their operations on the environment. This is usually done by forecasting the likely impacts of their activities, particularly on water quality, air quality, land use and flora. The beneficial as well as the negative impacts should be discussed with particular reference to socioeconomic and cultural concerns.

120. The environmental management/action plan should propose a final land-use policy or plan when mining operations cease. This is important because it is recognized that mining is only a temporary use of the land. Consequently, companies are expected to give some reclamation plans indicating the ameliorative and intervention measures envisaged. The management/action plans also include monitoring programmes, emergency plans, schedule of activities, estimated costs, personnel for environmental management, etc. Some companies also describe some aspects of occupational health and safety, even though these are not strictly required.

121. Environmental objectives are set individually for each project and these are based on the baseline data collected and collated prior to mining. This approach has been necessitated by the fact that environmental standards are only now being developed. Some recourse has been taken to international standards like those of the World Health Organization (WHO), the European Community (EC), the World Bank, etc., whenever warranted. It is recognized that this approach is unsatisfactory and can only be temporary. Concerted effort is therefore being made to set standards for water and ambient air quality.

122. The government of Ghana is using a mix of the polluter pays principle, the pollution prevention principle and economic incentives to ensure that companies behave responsibly, environmentally speaking. Self-regulation, voluntary compliance and development of integrated management systems are being encouraged. Technical assistance, incentives, peer and public pressure are expected to assume greater importance in promoting voluntary compliance of environmental legislation and standards. However, where persuasive strategies fail to change a company's behaviour sufficiently, it is expected that the Government will enforce the environmental laws. This is one of the reasons why the views of the mining companies and the public were solicited during the preparation of the environmental guidelines. Furthermore, all interested parties were asked to comment on the written instructions for the regulations prior to their drafting by the Attorney General's office in early 1994.

123. It is also noteworthy that the government of Ghana is placing emphasis on economic instruments.

For example, increased cost, if any, arising from environmental intervention measures taken by a mining company can be recovered by the company by virtue of the general capital allowances stipulated in section 26 of the Minerals and Mining Law. These are:

- depreciation or capital allowance of 75 per cent of the capital expenditure incurred in the year of investment and 50 per cent in subsequent years;
- losses in each financial year not exceeding the value of capital allowances for the year may be carried forward;
- investment allowance of 5 per cent; and
- capitalization of all expenditure on reconnaissance and prospecting approved by the Minister (for Energy & Mines) on the advice of the Minerals Commission where the holder starts development of a commercial find.

IV. ASSESSMENT OF POLICIES AND ENVIRONMENTAL PRACTICES

A. Policy development

1. General

124. Government environmental legislations and implementations are best based on environmental policies and plans formulated by Ghana within its socioeconomic and cultural context and the broad concept of sustainable development. The principles and goals of Ghana's response to environmental and developmental issues place Ghana within the "avant garde" of developing countries with regard to environmental awareness. However, as a result of various constraints, mainly financial, the implementation of policy goals and legislation has been slow. Furthermore, the policy goals are yet to be quantified and the so-called regulatory cycle (legislation and standard setting; permitting; implementation; and compliance enforcement) is only partially developed. For these reasons, practical experience of the policies is limited and the discussion in the following is therefore, of necessity, mainly qualitative in nature.

2. Economic development and environment in Ghana

125. This section of the paper is based on edited extracts from Ghana's NEAP (4).

Economic development and environmentally sustainable growth

126. The sustainability of Ghana's economic and social development depends ultimately on proper and responsible management of the natural resource base and of the environment in general. The widely held view that there is an inevitable trade-off between growth and environmental degradation can be misleading. There are such trade-offs in the short run - but in the longer run, the factors which induce growth must be reconciled with the integrity of the natural resource base if growth is to be sustained and to benefit future generations. In Ghana, economic growth has been based primarily on the use of its renewable and non-renewable natural resources: forests, soil, water, biomass and other elemental resources. Proper management of this "natural capital" contributes significantly to regenerative growth and the long-run maintenance of consumption levels consistent with healthy and productive lives. Irresponsible attitudes to the natural resource base result in environmental degradation.

Economic justification for the Environmental Action Plan

127. In Ghana, environmental degradation affects production in agriculture, industry and services. It arises as a (neither desirable nor unavoidable) by-product of the processes of resource extraction and utilization in the production of goods and services in the various sectors. An attempt was made several years ago to estimate the costs imposed on the Ghanaian economy by environmental degradation in the

different sectors. The costs were based on 1988 figures - the year with the most adequate data prior to the preparation of NEAP in 1990. Ghanaians' willingness to pay to avoid or prevent such negative impacts was estimated using market prices where available, or estimates where market information was not available. The picture is incomplete in a number of respects. Nevertheless, even using very conservative assumptions, the costs of environmental degradation are clearly significant. Land degradation related to crop and livestock production activities imposes the greatest cost to the Ghanaian economy, with a total estimated annual cost of at least 28.8 billion cedis, corresponding to about US$125 million at the exchange rate prevailing at the time. These costs are largely attributable to productivity losses arising from soil degradation, soil erosion and loss of tree cover, and to a lesser extent costs resulting from rangeland degradation due to the grazing of livestock.

128. The next economic activity that suffers a significantly high environmental cost is forestry. The total cost borne by the country as a result of the loss of forests through fire, logging, fuel wood extraction, charcoaling and agricultural encroachment was estimated at 10.8 billion cedis per year, or about US$47 million. There are other costs which arise from the disappearance of rare species of animals and plants, the loss of non-wood forest products, the reduced benefits from research on sources of medicine, etc. Significant costs also arise from the disturbance of watersheds which lead to siltation and drying of water bodies and the consequent desertification. These costs were not estimated, but localized evidence suggests that they are significant.

129. Unfortunately, it is not possible, for lack of adequate data, to quantify the costs of environmental resource degradation arising out of mining and manufacturing activities. Estimates based on observations of damage to humans, animals, vegetation and water bodies support the case that such costs are substantial.

130. Some efforts have been made, however, to estimate the costs of environmental degradation from such activities as mining, manufacturing and urbanization by evaluating their impacts on human health. These costs have been captured in terms of lost earnings, cost of medical resources (doctors, nurses, technicians, equipment, etc.), and cost of drugs. The total cost is estimated to be as high as 3.8 billion cedis, or US$17 million per annum. This estimate obviously understates the true cost of illnesses arising from environmental degradation, because secondary effects (e.g. impacts on pregnancies, etc.) and the number of environmentally related premature deaths are not accounted for. Moreover, even the direct costs estimated above are an understatement because it has not been possible to capture the costs incurred by all persons affected. It should also be noted that longer term costs to the economy attributable to environmentally induced health problems - especially long-term losses in labour productivity - have not been quantified.

131. What emerges clearly from this analysis is that Ghana's economy sustains losses due to environmental degradation that amount to a minimum of 43.4 billion cedis or about US$189 million annually - equivalent to 4 per cent of the total GDP in 1988. It is important to note that it is only since 1984 that GDP growth rate has attained an average of about 5 per cent per year. In other words, Ghana's economic growth, even when it has been clearly positive as measured by conventional methods of national

income accounting, has been achieved almost entirely by "degrading" the country's natural resource base and thereby gradually destroying the foundation for future sustained growth and development. The significant magnitude, persistence and pervasiveness of environmental losses provided a strong case for taking action to reduce the damage through the National Environmental Action Plan.

Towards a remedial incentive framework

132. Environmental assets are conserved or destroyed for a variety of reasons, but one important reason - often the most important - is that it is in the immediate self-interest of individuals, communities, agencies and firms to conserve or destroy. When it is in the short-term interest of users to destroy Ghana's environmental endowment, it is very difficult for positive policy to prevail. What is necessary to redress and reverse the severity of the problems of environmental degradation is not necessarily more laws, regulations and enforcement mechanics, but greater reliance on incentive mechanisms that will induce the users of natural resources to perceive that it is in their self-interest to manage this resource base in a sustainable way.

133. Ghana's NEAP is emphatic about the fact that economic incentives that promote environmentally sound production and consumption activities are superior to approaches that rely on regulatory measures. The former are far more cost-effective and easier to administer than the latter. Moreover, they are largely "self-enforcing". The use of incentives will encourage individuals to manage the environment voluntarily and wisely on the basis of prospective rewards, whereas regulatory and enforcement schemes rely on involuntary (if not "coercive") measures which are prone to generate adversarial outcomes.

134. An important element in the country's environmental policy is therefore to determine whether, and to what extent, the incentives facing those using the environment encourage them to destroy it, and if so, how to redirect incentives so that conservation is encouraged. On a positive note, a serious attempt to provide an effective incentive framework for a benign management of the environment has to address the issue of ownership, control and use of resources, the transparency of rules and claims, the existence of effective functioning of markets and the issue of externalities.

135. It may be economically and financially beneficial for an individual producer or consumer to deplete or pollute an environmental resource because the cost of this depletion or pollution is borne by someone else, by society at large or by future generations. These externalities arise because individual economic agents face different time horizons. While factories that pollute water bodies or the atmosphere care about the short-run maximization of profits, society has to take a long-term view of what happens to the environment.

136. When externalities occur, public policy that seeks to ensure environmental resource conservation and integrity over the long run will need to consider ways to deal with them. This might take a variety of forms: regulatory and enforcement mechanisms are only one possible set of instruments that can be applied. Other incentives could be instituted. For instance, tax breaks could be given to factories that

institute new benign technologies or taxes could be increased for technologies that pollute the environment.

B. Ghana Environmental Resource Management Project (GERMP)

137. In view of the country's numerous environmental problems, and financial constraints, the Government, with the assistance of the World Bank, operationalized NEAP using the Ghana Environmental Resource Management Project (GERMP) as a vehicle for implementation. In fact, GERMP is to support the implementation of NEAP. It is expected that by the end of the five-year period earmarked for GERMP, a firm foundation will have been laid for sound environmental management in the country. GERMP is based on: (i) the intersectoral nature of many environmental concerns; (ii) the fact that many areas of government are being decentralized to district assemblies; (iii) the need to ensure that communities are involved in decisions about the use of environmental resources; and (iv) the fact that significant portions of the NEAP are to be implemented through planned or on-going sector-specific projects supported by external aid agencies, particularly in the forestry, urban, industrial and energy subsectors.

138. The main objectives of the project are to put in place the institutional and technical capabilities required for effective environmental monitoring, policy formulation and coordination; to support a pilot programme to combat soil degradation and erosion; and to help to prevent further destruction of the fragile resource base in the coastal zone, in which issues of global environmental concerns are partly involved.

139. GERMP includes three main components: (i) development of an environmental resource management system; (ii) land resources management; and (iii) coastal wetlands management. The details on these fall outside the scope of this paper. Suffice it to say, however, that the following benefits are expected to accrue from the project:

- improvement of the management of environmental resources by both Government and the people;
- improvement of the availability of information required to make decisions, thereby providing a better understanding of the environmental consequences of courses of action, and early warnings of pollution or degradation;
- development of appropriate methods so as to involve people in the planning and management of their own resources in the coastal wetlands and elsewhere, that could be used in wider national programmes.

140. The need for a clear decision-making process is equally important at the local level and at the centre. Government policy on decentralization, the identification of district assemblies as district planning authorities and the formation of district environmental committees provide a firm basis for local management of the environment. Strengthening the regional offices of the EPC and providing training for

district level staff with a view to developing a system for local environmental management are important in this regard. The importance of this system cannot be overemphasized as conservation based on community participation, reinforced by locally decided by-laws, will always be more effective than a centralized, top-down or legislative management system.

141. It has also been recognized that effective environmental management also requires the coordination of sectoral plans, most of which affect the environment in some way. The functions of the technical secretariat of the EPC in the environmental resource management system include, inter alia, the coordination of activities relating to the environment as defined in the NEAP. The role of the EPC is the creation of intersectoral networks that bring together the sectoral agencies whose programmes impact on the environment.

142. Four intersectoral networks have been set up: mining and industry, built environment, natural resources, and education. The environmental concerns of the mining and industry network include: pollution monitoring and regulations; impact of mining/industrial development; and hazardous chemicals/wastes.

V. CONCLUSIONS

143. The steady decline in the price of cocoa has clearly shown that for a sustainable growth in the Ghanaian economy, the country urgently needs to increase and diversify its export revenues. The medium- to long-term prospects for gold exports - currently the leading foreign exchange earner for the country - are quite good whereas those for cocoa are difficult to predict.

144. The main environmental concerns in Ghana include issues affecting land and water resources and those commonly related to industrial (manufacturing) and mining activities, or to human settlements. Although the underlying causes for environmental degradation are as important as the direct causes, they are often overlooked. Those identified in Ghana include rapid population growth, poverty and inadequate systems for land tenure and land management.

145. Mine-imposed sediment loading of natural drainages is the most significant and pervasive physical environmental impact from mining and mineral processing in Ghana. For this reason, Ghana's environmental guidelines for mining companies stipulate that "Any pre-existing water supply in use by a settlement or village inside or outside the concession area whose existing quantity, quality or accessibility is negatively impacted on as a result of mining or mineral processing operations or construction, shall be replaced with an alternative supply of at least equal quantity (i.e. water demand of village), quality or accessibility at the cost (construction, operational and maintenance) of the company."

146. The policy for mineral development in Ghana may broadly be subdivided into three parts: (i) national sovereignty over mineral resources; (ii) economic growth and development; and (iii) minerals conservation. Sovereignty over mineral resources is self-evident. The strategy adopted for economic growth and development, in this context, is to ensure that exploitation of minerals provides a fair share to both the country and the investor. Mineral resources conservation strategy involves ensuring efficient exploration, mining, processing, decommissioning, etc., in an environmentally responsible manner.

147. The promulgation of the Minerals and Mining Law, 1986 (PNDCL.153), and the setting-up of the Minerals Commission to regulate and manage the utilization of the country's mineral resources and coordinate policies in relation to them, have been instrumental in the rapid growth in the gold-mining sector. The role of the Minerals Commission as both regulator and promoter of the mineral industry is innovative and has proved to be quite successful.

148. Government environmental regulations and their implementation are best based on environmental policies and plans formulated by the country within its socioeconomic and cultural context and the broad concept of sustainable development. The main aim of Ghana's environmental policy is to improve the surroundings, living conditions and the quality of life of the entire citizenry, both present and future. It seeks to ensure reconciliation between economic development and natural resource conservation and to make a high-quality environment a key element supporting the country's economic and social development.

149. Environmental protection in Ghana is guided by the preventive approach, that is, with the recognition that socioeconomic developments must be undertaken in such a way as to avoid the creation of environmental problems. The key elements of Ghana's response to the environment and development issues include, inter alia:

- the setting-up of the Environmental Protection Council and the Ministry of the Environment, and assigning cabinet status to the sector Minister;

- initiation of principles, policy guidelines, key goals and priorities of development in relation to environmental sustainability;

- development and implementation of specific approaches to address the problems of integration between development and the environment;

- initiation of programmes and projects for sound development and environmental sustainability; and

- revision of environmental legislation.

150. The National Environmental Policy has been made functional through the preparation of a 10-year National Environmental Action Plan which in turn has been operationalized via the Ghana Environmental Resource Management Project. The approach is to enable the country to rationalize the use of its scarce resources while laying the foundation for sound environmental management.

151. Since minerals are wasting assets, the Government has introduced a Mineral Development Fund whereby 10 per cent of all royalty payments are recycled to the mining areas mainly to: (i) provide local infrastructure: and (ii) invest in forms of development other than mining in mining areas, e.g. agro-based cottage industries. A further 10 per cent of the royalty payments are used to finance the sector regulatory institutions and the Geological Survey Department.

152. Ghana is using the "bottoms-up" approach towards its environmental management. District Assemblies have been asked to be the organ through which national policies and programmes on the environment are translated into action at the local and district levels. District Environmental Management Committees of the District Assemblies receive technical assistance to monitor and coordinate environmental protection and improve activities in the district.

153. Environmental Impact Assessment (EIA) is a prerequisite for gold mining leases for concession areas exceeding 10 hectares. The EIA should include baseline information, impact assessment, mitigation measures and environmental management/action plan. The environmental management/action plan should indicate a final land-use policy or plan when mining operations cease. Existing mining operations are expected to submit an environmental report at the end of each calendar year, and also a two-year environmental action plan and a three-year rolling plan for the subsequent years.

154. The widely held view that there is an inevitable trade-off between growth and environmental degradation can be misleading. There are such trade-offs in the short run, but in the longer run the factors that induce growth must be reconciled with the integrity of the natural resource base if growth is to be sustained and to benefit future generations.

155. A policy instruments mix is required to ensure environmental stewardship. What is necessary to redress and reverse the severity of the problems of environmental degradation is not necessarily more laws, regulations and enforcement mechanisms, but greater reliance on incentive mechanisms. The Government of Ghana is using a mix of the polluter pays principle, the pollution prevention principle and economic incentives to ensure that mining companies, in particular, adopt good environmental practices. Self-regulation, voluntary compliance and development of integrated management systems are being encouraged. Where persuasive measures fail to change a company's behaviour sufficiently, the environmental laws shall be enforced if warranted.

156. Ghana is using the 'consultative approach' towards the formulation of environmental policy guidelines and regulations for the minerals sector. This approach has found favour with industry and the public, even though it tends to be slow.

157. Ghana has adopted an integrated approach towards environmental management of its resources. The environmental management of the country's mineral sector is being based on policy formulation, planning, legislation, institutional capacity-building, monitoring/evaluation and problem-solving and implementation of decisions - by the highest level of government, by sectoral agencies, by District Assemblies, and by traditional and other community authorities.

158. The policy challenges facing Ghana include, inter alia, the introduction of new policy mechanisms to: (i) encourage environmental innovation; (ii) make sustainability operational in terms of measurable policy targets and policy mechanisms for their implementation; and (iii) strengthening the environmental regulatory cycle.

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